

IN THE SPECIFICATION

The Paragraph beginning at page 4, line 9 is amended as follows:

A novel system and method for tailoring production recipes to changing processing and production needs ~~is~~ are described. In the following detailed description of the embodiments, reference is made to the accompanying drawings which form a part hereof,^{ft} and in which are shown by way of illustration specific embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention. It is to be understood that other embodiments may be utilized and that structural, logical and electrical changes may be made without departing from the scope of the present inventions. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present inventions is defined only by the appended claims.

The Paragraph beginning at page 5, line 9 is amended as follows:

Throughout the following detailed description, an example batch process manufacturing scenario is used to describe some embodiments of the invention. The example scenario is for a drying process. Figure 1 is a graph of a recipe for a drying process of an example scenario. As shown in Figure 1, the recipe contains three segments. Each segment of the recipe illustrated in Figure 1 shows how the temperature should be controlled to achieve the desired product dryness, but it does not indicate what the desired state of the product is at, upon execution of the recipe segment. For example, the first segment (S1) of the recipe may require the temperature of the vessel to be raised at a constant rate until it reaches an indicated endpoint. The desired state of this segment may be to remove absorbed gases and moisture from the product without product cracking. The second segment (S2) holds the vessel temperature constant to ensure that the product is completely dry. The third segment (S3) begins to cool the vessel temperature. According to previous practice, the recipe tells the process operator how long each segment should last; but the recipe does not include product characteristics or states that should be associated with each segment. However, ~~the~~ some embodiments of the advanced recipe of the present invention desirably integrate such product characteristics and/or desired states with the set of instructions provided by the original recipe.

The Paragraph beginning at page 7, line 29 is amended as follows:

Figure 4 is a more detailed block diagram of the processing modules of Figure 3 according to an example embodiment of the invention. In the example embodiment shown in Figure 4, processing modules for a knowledge-based information system comprise a Knowledge Builder 402, a Structured Knowledge Repository 404, and a Decision Maker 406. In one embodiment, the Knowledge Builder 402 derives high-level representations of knowledge through aggregation and correlation of multiple knowledge sources. The knowledge builder 402 ~~store~~ stores the high-level representations of knowledge in the Structured Knowledge Repository 404. The Decision Maker 406 uses this knowledge to evaluate and choose the optimal modification of recipe steps for a batch processing situation.

The Paragraph beginning at page 15, line 3 is amended as follows:

Thus, the Structured Knowledge Repository (SKR) 404 provides a mechanism for organizing disparate knowledge for storage and for retrieving and integrating it. The SKR 404 is designed specifically for user interaction and manipulation with the proposed CWA. Thus plant engineers can check or traverse through structured knowledge.

The Paragraph beginning at page 15, line 8 is amended as follows:

Decision Maker. In one embodiment, the Decision Maker 406 interprets production and process goals from the system or the user and provides one or more Advanced Recipes and other outputs. These outputs are displayed to the user to act on, revise or modify, and when a final recipe is decided on, the computed actions can be implemented in the controller. Whereas the Structured Knowledge Repository 404 organizes knowledge and provides links between specific pieces of information and the functional purposes to which it can be put, the Decision Maker 406 actually assembles that knowledge into an answer to a query—in the form of a recipe modification that meets desired goals and constraints.

The Paragraph beginning at page 15, line 17 is amended as follows:

The Decision Maker 406 ~~is provides~~ optimal recipe modifications based on the knowledge stored in the Structured Knowledge Repository 404. The Decision Maker 406 is also

provides a feedback path for continuous learning from users or experimentation and ~~provide~~ provides one or more solutions if requested. Users may want to inspect alternate approaches to achieve a goal.

The Paragraph beginning at page 15, line 22 is amended as follows:

In an example embodiment, the Decision Maker 406 is based on the Mixed-Initiative Planning paradigm. Mixed-initiative planning is a framework that allows a human user to interact with and guide an automated planner. The Decision Maker 406 will take decision-making guidance from knowledge in the Structured Knowledge Repository 404 and from the user. A more detailed discussion of mixed-initiative planning is provided in Goldman, Robert P., Guerlain, Stephanie, Miller, Christopher, and Musliner, David J. (1996) "Integrated Task Representation for Indirect Interaction Position Paper," AAAI SSS Computational Models for Mixed-Initiative Interaction, Stanford, CA, March 1997 which is herein incorporated by reference.

The Paragraph beginning at page 16, line 3 is amended as follows:

As a baseline, the planner generates possible scenarios that use the information in the Structured Knowledge Repository 404 to make modifications to the current recipe. One feature of the Decision Maker 406 is the coherent exploitation of our multi-formatted knowledge sources. Presently, no existing mixed-initiative planner incorporates input from so many different data representations. The Decision Maker 406 makes a best guess as to the most appropriate change. The Decision Maker 406 determines this best guess is by calculating a weighted decision based on the following factors:

- the reliability of the ML technique that generated the information,
- the statistical significance of the information (as based on the number of examples underlying the generalization), and
- the confidence that the technique places on the information.

The Paragraph beginning at page 16, line 15 is amended as follows:

For example, one extremely reliable technique may not have much data from which to make an inference, while another confident but less reliable technique uses a lot of data to generate its inference. The Knowledge Builder 402 will learn the reliability of each technique (using feedback through experimentation); the other two factors are provided by the component ML techniques.

The Paragraph beginning at page 16, line 20 is amended as follows:

The CWA modeling approach includes annotations of how to use the structured knowledge, and combined with the reliability, statistical significance and confidence factors, the Decision Maker 406 will be able to understand the knowledge, its applicability, and its tradeoffs to:

- explore and evaluate the justifications for a decision,
- change or extend domain information to account for missing information,
- make changes to alternative actions to restrict or correct their applicability, as well as
- develop and incorporate new actions as necessary.

The Paragraph beginning at page 16, line 29 is amended as follows:

The CWA approach to the structured knowledge repository 404 provides a foundation for developing this multi-purpose interface. The current context overlay to the repository is partitioned from the general knowledge, allowing different interactions for different types of knowledge.

The Paragraph beginning at page 17, line 3 is amended as follows:

The Decision Maker 406 will interact with the expert user, the SKR 404, and the Knowledge Builder 402 to create and modify a recipe to create Advanced Recipes that meet processing conditions. In one embodiment, the Decision Maker enables the user to guide the decision-making process by allowing the best decision to be made and learning to make better decisions in the future, which in turn will create an overall high-quality plan that satisfies the user's desires.

The Paragraph beginning at page 17, line 9 is amended as follows:

Thus, the Decision Maker 406 allows the user to modify recipes using knowledge from different sources. The Decision Maker 406 also allows the user to explore, evaluate, correct and create actions. Furthermore, the Decision Maker 406 is able to use the reliability and quality of different knowledge sources on which to base decisions.